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Synthesis and characterization of nanodiamonds-zinc oxide nanocomposites by ball milling technique

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Zinc Oxide (ZnO) is one of the very important transparent conducting oxides (TCOs) for applications in optoelectronic devices, which work in the blue and UV regions. The importance of ZnO as an optoelectronics material is due to its wide bandgap (3.37 eV) and larger binding energy (60 meV). However, to meet the demands of highly versatile ZnO nanomaterials for practical applications, various modifications in physico-chemical characteristics are required. The characteristics of ZnO could be effectively tuned by tuning the microstructure. One way for altering the properties is the synthesis of ZnO nanocomposite with various materials. Here we report upon the doping of ZnO with nanodiamonds (NDs) to effectively alter its optoelectronic properties. The doping is performed by ball milling technique. The effects of NDs contents upon the microstructure and subsequently, upon the characteristics of ZnO has been investigated in detail. The synthesis of the ND/ZnO nanocomposites are monitored by using different characterization techniques including IR spectroscopy, powder X-rays diffraction (XRD), Scanning electron microscopy (SEM) and energy dispersive X-rays spectroscopy (EDX). The optoelectronic characteristics are studied by using ultraviolet-visible (UVV) and photoluminescence (PL) spectroscopy. It has been found that the band gap decreases with increasing contents of NDs (Fig. 1). The red shift promises the use of ND/ZnO nanocomposite in solar cells, and photo catalysis system operating in the visible range of the sunlight spectrum.

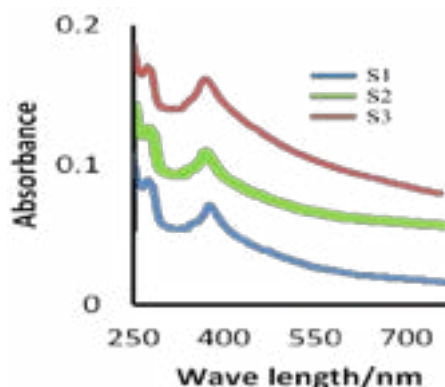


Figure 1. Red shift in the UV-Visible spectrum of ND/ZnO as a function of increasing NDs contents

Biography

Hameed Ullah completed his PhD from the University of Saarland, Germany under the supervision of H.C. Michael Veith. He has worked upon the synthesis of single source molecular precursors which have been used in MOCVD process for preparation of nano thin films. After completion of PhD, he has joined Hazara University, Pakistan, as Assistant Professor. He has published numerous articles in peer reviewed journals and presented his research work in various international conferences in different countries. He has many MPhil and PhD students under his supervision working upon the synthesis, characterization and applications of nanomaterials. He is serving as a reviewer of different international journals.

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